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GEOLOGICAL MAP

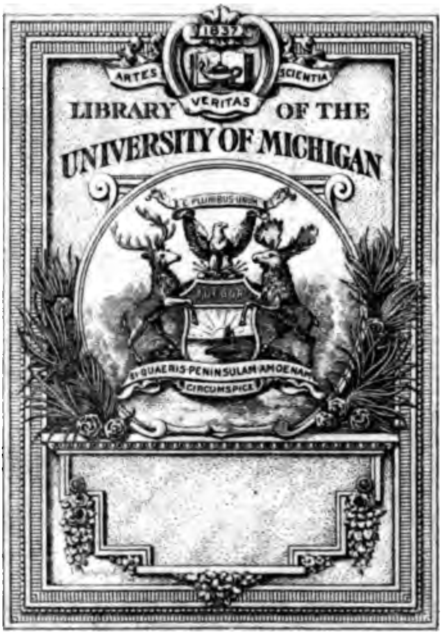
OF

NEW YORK CITY AND VICINITY,

BY

DANIEL S. [illegible] MARTIN.

1888.



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GEOLOGICAL MAP
OF
NEW YORK CITY AND VICINITY,

BY

DANIEL S. MARTIN.

NOTES AND EXPLANATIONS.

In publishing a Geological Map of the Environs of New York, the author has acted upon the suggestion of scientific friends, who felt interest in the map prepared in connection with his paper on the geology of the region around the metropolis, read before Section E of the American Association for the Advancement of Science, at its meeting held in New York in August, 1887. As there was no map in existence suited to illustrate that paper, he constructed one for the purpose, though with no idea of publication. Requests were made, however, for copies; and therefore the issue of a small edition was subsequently determined upon.

[illegible] preparing a copy for publication, however, far more was necessary than for the single map used at the Association. It was not enough that the general features should be clearly and boldly presented. Every detail, as far as possible, must be accurately determined, and the map made fit to bear the tests of close and careful study. After long and patient work, there are still some points in which precision is not fully attainable; and so far, therefore, this map is still provisional. Nevertheless, it undoubtedly contains more and newer material, and covers a greater number of important points, than have ever been brought together before in any map of this region.

The following notes upon the map—as to what it claims and what it does not claim, and the principles and methods of its construction—are offered for the guidance of those who use it. Some of the points treated of are designed mainly for professional geologists, and others, as particularly the outlines under head 6, for the general student or instructor.

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involves, of course, some uncertainty, at points, as to the limits, the outlines, or the continuity, of some of the underlying rocks. The map, however, represents the best approximation thus far attained, and perhaps for some time attainable.

Let it be borne in mind, however, in using this map, that the yellow and glacial drifts are by no means confined to Long Island, as might at first appear, but extend widely over the corresponding areas, respectively south and north of the Terminal Moraine—yet seldom so deeply as to render the underlying rocks unknown.

A somewhat similar, though less important, point may be noted in regard to the salt-marsh deposits of the coast. Instead of employing an additional color for these, which form a marked geographical feature of the region, and of course conceal wholly the country rock, it was finally decided to indicate them by cross-lining, in the lithographic work. There are only a few points (as in the western part of Staten Island), where these recent deposits cause any uncertainty as to the true limits of the geological formations beneath.

In the region of northern New Jersey, however, some unsettled questions had to be met. It is now known that the "Green Pond Mountain" series, long supposed to be of Potsdam age, is really at the base of the (Upper) Silurian, and represents the Oneida and Medina rocks of New York State, or the Levant (No. 4), of the First Pennsylvania Survey. The hights here are therefore "mountains of Four," and are colored accordingly They doubtless rest upon Ordovician beds, which are seen outcroppi g at a few points on the eastern edge, and forming an island in Greenwood Lake, close to the State line. But the slates and shales of the adjacent valleys are the most uncertain ground in the map. They were long called Hudson River, but now are proven to be, at least in part, of Hamilton age. What portions, however, are such, and what may be still regarded as Ordovician, are points that are as yet unknown, and will require careful field-work to determine Under these circumstances, after much deliberation, and full conference with the latest explorers of that area, Drs. Britton and Merrill, the author decided to use the Devonian coloring, provisionally, and to indicate the partial uncertainty by a reference in the Legend

4. *Nomenclature.*

As will have been already perceived, it has seemed best to the author to accept the name Ordovician for what has been usually called Lower Silurian, and restrict the term Silurian to the "Upper" division. This course is deemed preferable for the sake of simplicity and clearness, in view of the tendency in this direction abroad, and of the long discussions and disputes that have made the name Lower Silurian unfortunate in geological literature. The terms Cambrian, Ordovician and Silurian should now have definite meanings, and be free from past complications.

A much-vexed question, of course, was encountered in regard to the gneissic rocks of New York Island and the region east of the Hudson. The gneiss of the New Jersey Highlands is by general consent Laurentian, and so is laid down in the deeper shade of pink—according to the color-scale—as the oldest of these terranes. But the other series is celebrated as a very battle-ground of geologists and lithologists, where eminent champions have "met in stern array." It is needless to rehearse the discussion here. These gneisses are by some regarded as Laurentian, like the Highlands, though lithologically variant; by others as later Archæan, under the name Montalban; by others again as altered Cambrian and Ordovician. The author of this map, though personally inclining to the second of these views, does not feel that we are yet sufficiently sure as to the age of this body of rocks, to render it wise to assign a name involving a positive opinion, and has therefore referred to them by a purely geographical term, as the "Atlantic or Manhattan gneiss." He has himself employed elsewhere the name "Tidewater gneiss" for the same rock, as expressing the fact that its southern extension, from Trenton, N. J., to Virginia, causes falls or rapids in the streams that cross it on their way to the sea, and has thus determined the limit of tidewater navigation, and hence the location of many important towns.

The color given this gneiss, a lighter pink than that of the New Jersey Highlands, is provisionally suitable to any view of its age, save that which regards it as true Laurentian, identical with the other.

Of course, the crystalline limestones in these two series of gneisses, share in this uncertainty as to age. No attempt has been made to distinguish them, however, although their associations and modes of occurrence, in the two regions, are in some respects markedly distinct.

The trappean rocks of the New Jersey Triassic area are referred to and colored as diabase. They have been often called diorytes, and by some, hyperytes; but the author has followed here the decided judgment of Dr. A. A. Julien, whose minute and extensive studies in microscopic lithology have led him to this conclusion.

5. *Topography.*

The basis of this map is the Indexed Map of New York and Vicinity, published by Mr. E. C. Bridgman, in 1887. It has been retransferred on stone for the present purpose, in order to insert some additional matter, e. g., the Terminal Moraine, the salt-marsh areas and the off-shore soundings. The general topography is based on the newly-issued sheets of the New Jersey State Survey.

The geological boundaries have been laid down with great care from the several editions and revisions of the N. J. Geological Survey. Outside of that State, the principal sources employed are Prof. J. D. Dana's maps of the limestone areas of Westchester County, etc., published in the American Journal of Science, and Dr. N. L. Britton's map of Staten Island, in the Annals of the New York Academy of Sciences.

For the eastern half of the Terminal Moraine, the course was laid down by enlargement from Mr. F. J. H. Merrill's map of Long Island (Annals N. Y. Acad. Sci., vol. III), and its details more fully given by reduction from the large and elegant chart No, 369, of the U. S. Coast and Geodetic Survey.

The deep-sea soundings are enlarged from the Coast Survey Chart No. 8a, of the Approaches to New York Harbor, on which is shown with great beauty the long reach of the deep submerged valley that marks the glacial and pre-glacial channel of the Hudson, far out to sea. The limits of the present map include only the extreme north-western portion of this remarkable depressed line, and so can furnish but a very inadequate idea of its striking extent.

It is to be regretted that both these government maps, of so much interest to geologists, are already becoming scarce, being out of print and not likely, it is said, to be reissued at present.

6. *General Geology.*

The area covered by this map is of especial interest, in that it illustrates within a small compass, so much of the geology of the Middle Atlantic States. The general relations of the rocks may be briefly outlined as follows:

The trend of the great Appalachian mountain-system (to say nothing of earlier causes) has determined the outcrop-lines of nearly all the geological strata of the eastern United States, giving them the character of an assemblage of parallel belts, more or less exposed by erosion and modified by a variety of local causes. Their general course, or "strike," is from N. E. to S. W.—the ancient crystalline rocks forming the axes and "divides" between the later stratified deposits, which rest upon or against the former, and "dip" away from them in directions more or less at right angles to the strike, i. e., towards the seaboard or the interior, as the case may be.

In this map, all these relations may be seen, as it represents a characteristic portion of the region referred to, including most of the rocks of the Atlantic slope.

The old gneisses, indicated by the strong deep pink, form the eastern edge of the great Appalachian system, and are locally known as the Highlands of New York and New Jersey. As will be seen, they form the divide between the Palæozoic rocks to the N. W., and the Mesozoic and Cæno-zoic terranes to the S. E. They reach and cross the Hudson a little beyond the northern limit of the map, affording the magnificent scenery on that river between Peekskill and Newburg. Southwestward, they stretch down for hundreds of miles, passing into the South Mountain and Blue Ridge of Pennsylvania and Virginia respectively.

In the region of northern New Jersey, several belts of this gneiss have been distinguished by the State Geological Survey, and named successively the Ramapo, Passaic, Musconetcong and Pequest belts. This division, however, is one of convenience only. The Ramapo and Passaic belts, are respectively the first and second met with in going west from the Hudson ; they form on the map a continuous band of color, save at the southwest extremity, but are separated by a strong broken line. Along their line of junction, there are small outcrops of crsytalline limestone, often with serpentine, but only a few of them can readily be shown on this map. The Musconetcong belt comes next, after the Silurian rocks of the Green Pond Range ; and the Pequest belt lies further to the northwest.

These gneisses are remarkable for the great series of iron mines which they contain, especially along the lihe of the first two belts. The ore is chiefly magnetite, and has been worked from an early period of the settlement of the region. The industry was of especial importance during the Revolutionary War, when other sources were largely cut off.

Most of the rock is true gneiss, thoroughly metamorphic, but retaining evidences of original stratification. Occasional outcrops of crystalline limestone are shown, and one great belt extending north-east from Franklin furnace.* But recent field-work has revealed small areas of doubtless earlier, or "fundamental," gneiss, with no trace of stratification, and an almost intrusive aspect. The limited size of these outcrops, and their as yet but imperfectly known outlines, preclude their representation in this map, although it was much desired by the author.

The Palæozoic strata, adjacent to these gneisses, are much disturbed and confused for some distance ; but their general character, as N. E. and S. W. belts, can be clearly seen.

Those first encountered are the sandstones and conglomerates of the Green Pond Mountain series, before referred to, forming a smaller range parallel in direction and equivalent in age to the great Shawangunk Mountain, which latter stretches from Ulster County, N. Y., far to the southwest along the Alleghanies, and is there known as the Kittatinny and the North Mountain. This Green Pond range (Levant, No. 4), has local outcrops of underlying Ordovician at a few points along its eastern base, and is flanked on the northwest by the disputed, but in part certainly Hamilton, slates alluded to previously.

Northwest of these, after passing over another belt of Archæan gneiss and crystalline limestone, lies the true Ordovician (Lower Silurian) terrane. This consists chiefly of magnesian limestones and overlying shales, representing the Calciferous, Trenton and Hudson river rocks of the New York nomenclature, or the Auroral and Matinal of Rogers (Numbers 2 and 3 of Pennsylvania). With these, the limits of the map are reached.

Turning now to the later terranes that lie to the south-east of the Highland gneiss, we have the great groups of the Mesozoic and Cænozoic largely displayed, the former in two of its three systems, the Triassic and the Cretaceous. Between these last, the Atlantic, Manhattan or Tidewater gneiss forms again a divide, though not always visible as an outcrop. This gneiss, largely developed in New England, and reaching from Philadelphia far to the southwest, sinks below the surface for most of the way across New Jersey. It is seen on the map, running out on Staten Island, and though struck in wells and borings, is not visible until Trenton is reached, where it rises in an outcrop of limited area, and again sinks until it appears in force near Philadelphia. Where it is thus depressed, the Cretaceous strata are seen resting against the Triassic, as from Staten Island to the Legend, on the map. But their dips are entirely distinct, that of the the Triassic being landward and that of the Cretaceous seaward.

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* It is in this belt that Dr. N. L. Britton has lately discovered the graphite-films that apparently retain their vegetable form, and are described by him as the earliest known remains of plants, under the name of *Archæophyton Newberryanum* (Annals N. Y. Acad. Sci., Vol. IV).

The Trias or Jura-Trias, thus occupies a long narrow trough between the two series of gneisses, which limit the belt on either side. Its northern portion is shown in this map. It has a pretty uniform character, as a body of sandstones and shales, dipping gently N. W., poor in fossils, and reddish brown in color from the abundance of sesquioxide of iron. It is largely used as a building material—the familiar " brown stone " of New York and vicinity —and as such is handsome, abundant, and easily worked, but too often lacking in durability. Like the corresponding belt in the Connecticut Valley, though to a less extent, it yields in some places fossil plants, reptilian footprints, and ganoid fishes, which have great interest to local geologists, and serve to complete the identification with the Connecticut belt, which all its lithological characters so strongly indicate.

The New Jersey Red Sandstone often contains small amounts of copper, as does also that of Connecticut. In some places, this is in workable quantity, especially at the old Schuyler Mine, near Belleville, N. J. This was the earliest copper mine worked in this country ; and the first steam-engine in America was brought over and set up here in 1753, the mine having been then operated as far as hand-pumping could well be carried.

The most marked geographical feature of this terrane is the remarkable series of trap-ridges which it includes. Their long narrow outcrops, parallel to the general strike, and curving around westward at their northern and southern ends, are conspicuous upon a map. These are the edges, exposed by erosion, of true intercalated, or interbedded, sheets of trap, forced upward in a state of (doubtless hydrothermal) fusion, through dykes and fissures which are usually concealed from view, and spreading out between the layers of sandstone above and below. Subsequent tilting of the whole terrane to the N. W., and vast erosion of its surface, whereby the softer intervening strata have been worn down more than the harder trap, have left the eastern edges, and to some extent the curving ends, of these igneous sheets projecting above the general surface, while their western portions lie buried under the sandstone. It will easily be understood from this position, why it is that these trap ridges present steep broken faces to the east, and slope away gently to the west. The most extensive of them is the Palisade range, which forms so grand a feature on the west side of the Hudson for many miles, its precipitous columnar face rising hundreds of feet from the water. Further south, it recedes from the river, and becomes the Bergen ridge, back of Hoboken and Jersey City. Gradually sinking, it extends southwest, and disappears on Staten Island, but again comes to view twenty miles away, between New Brunswick and Monmouth Junction; while the little local outcrop at Martin's Dock on the Raritan, is doubtless a part of the same. The next important ridges are the closely approximated First and Second Orange (or Newark) mountains; and a fourth great sheet may be traced in the irregular broken series of outcrops yet farther to the west. Besides these, many small separate areas occur.

The trap is largely quarried, especially at Weehawken, for street paving-blocks, and to a limited extent for building-stone. The railroads that approach New York from the west, have to pass through the Bergen Hill by deep cuts or tunnels. In the construction of these, vast numbers of beautiful minerals have been obtained, chiefly the zeolites, which have made the name of Bergen Hill familiar to collectors all over the world. The trap itself is often rudely columnar in structure; and sometimes this feature is finely displayed, as at points on the Passaic near Little Falls, and at the celebrated locality on the east face of Orange Mountain, a mile westward from Orange station. (D. L. & W. R. R).

This whole Jura-trias terrane, in all its features—sandstone and trap, fossils and minerals,—corresponds closely to the Connecticut Valley area, with one marked exception. The dip of the latter is eastward instead of north-westward; and this fact causes the trap ridges, with a similar surface-contour, to hold a reversed position from those of New Jersey, i. e., to present their steep broken edges to the west, while their curving ends and their back slopes are toward the east. The interesting discussion as to the relation of the two terranes, would transcend the limits of this pamphlet.

At the eastern edge of the Trias lies a belt of serpentine rock, which appears at many points on the western border of the Atlantic gneiss, with which it is undoubtedly connected, though its age and origin are uncertain. On the map, three main outcrops are shown, Staten Island, Hoboken, and on the west side of New York Island; the last is now pretty much removed or covered by buildings, etc. A similar serpentine, with similar associated minerals, occurs at Rye and at New Rochelle, though these small outcrops could not readily be shown on the map. The Staten Island area is the most extensive, but that of Hoboken is the most conspicuous; as the light green rock rises directly from the river at Castle Point, and with the sea-wall of the same material, forms a striking feature. Unfortunately, this beautiful rock is scarcely suitable for architectural use—as it is near Philadelphia—being here broken, disturbed, and frequently lamellar. It is rich in magnesian minerals; and Hoboken and Staten Island have long been "classic ground" to the collector.

South-east of the Atlantic gneiss lies the Cretaceous system, largely developed in New Jersey. Its lowest member is the series of Plastic Clays, including at its base the Raritan sandstone. This latter is strikingly similar, in its fossil angiospermous leaves, to the Dakota sandstones of the West, and is the lowest horizon at which such plants have been found. The clay-beds, so fully treated of in Prof. Cook's "Report on Clays," form the basis of a most important and growing industry in fire-brick, stoneware, terra-cotta, and porcelain, along the line of outcrop extending from Staten Island to Trenton. These clays also, at many points, yield fossil plants, largely ferns and gymnosperms. Following these, are the so called Lignitic clays and clay-marls (colored of a yellowish-green, separated by a broken line, and distinguished as A and B near the right-hand edge of the Legend.) Next comes the Lower Marl Bed, followed by the Middle and Upper belts, separated by intervening red and yellow sands. The Lower bed is regarded as equivalent in age to to the Fort Pierre series of the West. These marls, "greensands," are of immense practical importance as fertilizers, in the sandy regions of southern New Jersey, and were therefore deemed worthy of a distinct color (olive), not provided in the International scale. Though closely related in composition, origin, appearance and use, the three beds are quite distinct, geologically as well as geographically, and their respective fossils are different and often diagnostic. Their value as fertilizers is due to the dark green grains (whence the name greensand) of which they are largely composed. This material is chemically a hydrous silicate of iron and potash, known in mineralogy as glauconite. The grains are for the most part casts of rhizopods ; and this peculiar replacement—a filling of the cavities occupied by the protoplasm of rhizopods by this or similar silicates,—occurs also at various horizons, from the earliest fossiliferous rocks to the present time. The bearing of this fact upon the much-disputed question as to the organic character of *Eozoon*, is evident, but can only be alluded to in passing.

Between the three marl-beds are two distinct sands, the earlier one, the Red Sand of the New Jersey State Survey, separating the Lower and Middle marls, while the later, or Yellow Sand, holds a corresponding place between the Middle and Upper marls. On the map, these sands are tinted alike with the pale green of the Upper Cretaceous and marked A and B, respectively, on the lower margin. This yellow sand must be distinguished from the much later surface-deposit, called the Yellow Gravel or Yellow Drift, which covers much of the same area.

The Upper Marl-bed is the highest member of the Cretaceous system in the Eastern States, and passes into the Eocene Tertiary with very little break. The lower portion of this third belt of greensand is undoubtedly Cretaceous, while its upper portion (perhaps about one-third), is shown by its fossils to be Tertiary. The precise line of demarcation cannot be strictly indicated, from the covering of the country hereabout by the Yellow Drift ; and for the same reason, the boundaries of the Middle and Upper Marl-beds generally are as yet somewhat ill-defined.

No Meiocene Tertiary is clearly recognized ; though a thin layer above the Eocene marl, at some points, has been referred to this epoch.

The Yellow Gravel or Yellow Drift overlies all the coast region of New Jersey, and in turn underlies the Glacial Drift. These facts of course fix its horizon, as late Pleiocene or early Quaternary. For the sake of distinctness, the Pleiocene color was given to it on the map ; although, for reasons already given, it is only shown along the immediate seacoast and on Long Island.

This material consists chiefly of pebbles of quartz, white or hyaline, but more generally stained various shades of yellow by oxide of iron. So abundant is this latter substance, that it sometimes cements the grains and pebbles of quartz into a ferruginous conglomerate, which is of frequent local occurrence in the area covered by the deposit. The same is common also, in the Cretaceous Red Sand. The pebbles and sand of the sea-beaches of New Jersey and Long Island consist chiefly of this Yellow Gravel, intermingled with magnetic iron and garnet sands, which appear at times in layers, sorted according to gravity by winds and waves, and thus forming the dark lines and streaks, blackish or reddish respectively in color, which are so frequently seen on the white and yellow beaches, diversifying "the ribbed sea-sand."

Quaternary.

The true Glacial Drift overlies, as has been said, much of the area north of the Great Moraine. It frequently conceals the country-rock, or fills up depressions therein, so as to cause apparent breaks of continuity. This is the case at several points on New York Island, for instance, where the drift fills large transverse valleys in the irregular and eroded gneiss. (These are not shown on the map). It is generally a true "till," consisting of earth and clay filled with stones and boulders, which may be recognized as derived from rocks to the north and northwest. It is everywhere limited on the south by the Terminal Moraine, which marks the greatest extension of the ice-sheet ; while at some points there are smaller and local "moraines of recession," showing stages in its retreat.

The moraine itself, now traced, state by state, from the Massachusetts coast to Minnesota, is here seen on the map, forming a great southward loop, corresponding doubtless to the lobe or tongue of ice that passed down the Hudson Valley. Its course across the continent is marked by such lobes or loops, with intervening recession-lines upon regions of mountain or highland. Its finest exhibition hereabout is no doubt on Long Island, where it forms a chain of hills, known as the "backbone" of the island, which furnish elevated sites for Prospect Park, the Brooklyn reservoirs and water-works, and the several cemeteries from Greenwood eastward, and also for the forts at the Narrows, where the moraine crosses the bay of New York. The Long Island drift is finely shown in the cuttings for the railroads to the sea-beach resorts, and in the street-openings in the southern and eastern parts of Brooklyn. It is full of great boulders, chiefly from the gneiss, the trap and the Triassic sandstone, lying to the north-west. These furnish the only material for rock-work in Prospect Park, which in this respect presents a striking contrast to the rugged and glaciated gneiss-exposures of Central Park in New York. Boulders of fossiliferous rocks (Palæozoic) are also found, though more abundantly at points further west, as on Staten Island and the mainland of New Jersey.

South of the Great Moraine, Long Island is mantled with a stratified drift, which is generally considered identical with the Yellow Gravel above referred to, though locally modified by subsequent fluvial action from the melting ice-sheet. It is fair to state, however, that so eminent an authority on this subject as Mr. Elias Lewis, is disposed to regard this as different from the New Jersey Yellow drift, and to consider it a true Champlain deposit.

The ice-sheet has left its conspicuous traces upon all the rock-surfaces that appear, northward of the Great Moraine. Glaciated outcrops and *roches moutonnées* are characteristic and abundant, and nowhere more so than on New York Island In Central Park and along the Riverside Drive, excellent examples of these phenomena are readily observable ; and in some cases the grooves and scorings are grand. Large stranded boulders are also conspicuous.

The New York gneiss forms the islands in the East River and underlies the northwestern part of Long Island, as above stated, outcropping largely around the Court House near Hunter's Point, and at neighboring spots along the Long Island R. R., and on some of the points of the North Shore. Its limits, however, can be only approximated, owing to salt marshes and the heavy drift.

Beneath the glacial drift-mantle, on the bays and fjords of the North Shore, appear stratified clays, with lignite and pyrites, which are so similar in general character, and in position, to the Lower Cretaceous clays of New Jersey and Staten Island, that there can scarce be a doubt as to their identity. These, as located by Mr. Lewis, are shown on the map, so far as they fall within its area.

Modern.

The only points of importance under this head are : (1) the salt-marshes of the coast, referred to before, which are shown on the map by oblique cross-lining, producing a deeper shade with the color of the underlying rock, and (2) the depth of water, indicated by successive tones of pale blue, along the lines of off-shore soundings. The former require no particular description, as they have the general character of such deposits all along the Atlantic coast. The latter, however, may call for a brief description.

The existence of a great submerged valley reaching from the mouth of the Hudson nearly a hundred miles south-east, to the edge of the "continental plateau," has been known and referred to somewhat, as one of the most marked evidences of great elevation of the land in the Glacial Age.

Only the northwestern end of this valley lies within the field of the map, but enough appears to give some idea of its position and character. Its course is at first nearly north and south, but further on it turns more to the eastward ; and the beginning of this turn can be seen at the lower edge of the sheet. All the evidence goes to show that before and during the Age of Ice, the whole northern part of the continent stood far above its present level ; all the rivers and streams within the drift-covered area having cut their valleys down into the country-rock far below the present level of the ocean and the Great Lakes. At that time, as shown by Newberry, Manhattan Island was a lofty rugged promontory, with the rivers on either side flowing in deep cañons or gorges to meet in what is now the Bay ; that there a mighty stream was formed by the union of the Hudson with the rivers of New Jersey on the west, and with a river from the east that drained southern Connecticut and probably included the Housatonic ; and that this combined body of water, after passing lofty hills where are now the islands and shores of New York Bay, flowed a hundred miles south-east through a low and level region, to reach the ocean. The channel of that great river is marked on our charts by this line of deeper soundings.

The subsequent Champlain depression gradually carried the whole region below the present level, and has left the elevated beaches and stratified drift, which attest its reality and mark its bounds. The deep-cut river-channels were filled up with drift-deposits, as is the case through most of the Northern States.

The rise that followed, in the Terrace Age, was marked by the partial re-cutting of their valleys by the rivers ; but this work was done in the stratified filling, and does not reach at all down to the older and lower rock-channels. As an instance of this fact, it may be noted that the proposed Hudson River Tunnel from Jersey City to New York, is carried through hard clay with common marine shells, semi-fossilized, and nowhere touches the deeply-buried ancient rock-bottom.

Since this last rise, a reverse movement has set in, which is still in progress. From this point southward to the Carolinas, the Atlantic coast appears to be sinking The shore has receded very decidedly during the past hundred years, as shown by a great mass of evidence and testimony. Old deeds and surveys, the personal recollections of aged dwellers on the coast, and numerous and extensive areas of submerged meadow and buried forest, all unite in proof of this striking fact. The "mining" of cedar timber in the New Jersey coast swamps is an important industry ; and around the harbor of New York, peat-beds buried beneath the sands of the beach, and exposed only at very low tide or by storms, are not infrequent. For the full and systematic investigation of this interesting topic, as also for so much else in the geology of the entire region, credit is due to Prof. Geo. H. Cook, of the New Jersey State Survey, and his corps of assistants. The care, judgment and practical value of the work given in the several volumes and reports of this survey, deserve high consideration.